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AUTHOR Harder, Virginia; Talbot, Lynne
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ABSTRACT

To get a preliminary understanding of how mathematics methods courses are taught, this study examined course syllabi from as wide a range of public and private universities as possible. Mathematics methods course syllabi from 200 randomly selected members of the Association of Mathematics Teacher Educators (AMTE) were requested. Following the second mailing, the return rate was 33% but only 45 syllabi--a 19.5% return--met the criteria for this study. Each syllabi was read five times. The first reading showed the wide range of syllabi from very descriptive to a basic outline of course objectives and assessments. The next three readings developed the categories of instructional approaches, instructional projects, and assessments. Eleven categories of instructional approaches, five categories of instructional projects, and four categories of assessment types were identified. (ASK)

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HOW ARE MATHEMATICS METHODS COURSES TAUGHT?

BY

Dr. Virginia Harder

and

Lynne Talbot

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1

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The concern for the quality and process of mathematics education is increasing. Mathematics educators and the schools that hire their graduates are concerned with how preservice mathematics teachers are being prepared for their professional lives. Surprisingly little knowledge about the manner in which students in methods classes are taught is known. At the AMTE (Association of Mathematics Teacher Educators) conference there were many discussions both in formal sessions and in the corridors about the ways in which we prepare and teach our courses, what books we use, what activities we involve students in, how we assess their progress, and other aspects of preservice education. However, our knowledge has always been informal.

With little formal knowledge of how preservice teachers are educated, all we have been left to fall back on are our own experiences in teaching the course and our shared conversations with peers. While this approach has been serviceable to some extent, it does not provide much help for those unable to travel to conferences, those who only converse with colleagues whose practices are similar, or those who simply want to know what is potentially available to them in teaching a methods course. To get a preliminary understanding of how *mathematics methods courses* are taught, this study undertook to examine course syllabi from as wide a range of public and private universities as possible.

We requested course syllabi from two hundred randomly selected members of the Association of Mathematics Teacher Educators for their mathematics methods course. Following a second mailing we received a return of 33%. However only 45 syllabi, a 19.5% return, met the criteria of this study.

The primary goals in analyzing these syllabi were descriptive to determine the ways in which mathematics educators across the country organize a methods class, to find out what texts are being used, to see what types of activities and assessments students are engaged in, and generally to present a description of what types of experiences preservice teachers are having prior to going into their student teaching experience. We read each syllabi five times. The first reading was done individually, to gain an initial impression regarding the overall structure, the books read, types of projects required, and whatever other information the syllabi revealed about the content and methods of the course. Only the frequency of the books read were tabulated during this reading. Following the first reading, the other readings of the syllabi were done collaboratively. The second reading of the syllabi generated the preliminary categories of instructional approaches, instructional projects and assessments. The third and fourth readings refined each of these categories.

The fifth reading focused on the extent to which the NCTM (National Council of Teachers of Mathematics) standards influenced the syllabi.

Results:

The first reading showed the wide range of syllabi from very descriptive to a basic outline of the course's objectives and assessments. During this first reading each researcher recorded the textbooks required for the course. Table 1 gives a list of these texts and the frequency.

The next three readings developed the categories of instructional approaches, instructional projects and assessments. We identified eleven categories of instructional approaches. The most common approaches indicated were whole class and group discussions. Sixty-one percent of the syllabi stated either in their course description or in the class schedule discussions on the readings and in class assignments were part of the course syllabi. Most of the courses, 63%, emphasized lab experiences in their syllabi. The lab experiences included use of graphing calculators, software, internet and manipulatives. Student presentations were also a major approach. Fifty-one percent of the course syllabi included student presentations on journal articles on current trends, resource materials, activities developed and student research. Besides student presentations 23% of the syllabi required either micro-teaching or peer teaching. The topics for the micro-teaching or peer teaching were usually mathematics

Table 1 Textbooks Required in Courses

Title	Author	Count
NCTM Standards	NCTM	11
Teaching Secondary School Mathematics Techniques & Enrichment	Posamentier & Stepelman	8
Every Minute Counts	D. Johnson	6
Making Minutes Count Even More	D. Johnson	5
Mathematics Methods for the Elementary & Middle School	Bitter, Hatfield & Edwards	3
Motivation Counts	D. Johnson	3
Secondary Mathematics Instruction: An Integrated Approach	M. Farrell & W. Farmer	3
Research Ideas for the Classroom	P. Wilson	2
Teaching Mathematics, A Sourcebook of Aids, Activities & Strategies	M. Sobel & E. Maletsky	2
Addendum Series Middle School	NCTM	1
Addendum Series 9 - 12	NCTM	1
A Collection of Math Lesson from Grades 6 through 8	M. Burns & C. McLaughlin	1
Developing a Topic Across Curriculums: Functions	T. Cooney	1
Elementary School Mathematics: Teaching Developmentally	J. Van de Walle	1
Helping Children Learn Math	Reys, Suydam & Lindquist	1
How to Solve It	G. Polya	1
How to Teach Mathematics	Krantz	1
Mathematical Assessments	J. Stenmatck	1
The Mathematics Teacher	NCTM	1
Problem Solving Strategies-Crossing the River with Dogs		1
Putting it Together: Middle school math in transition	G. Tsuruda	1
Student Teacher's Handbook	Schwebel et. al.	1
Teaching Elementary School Mathematics	Riedesel, Schwartz & Clements	1
Teaching Math in Secondary and Middle School	J. Cangelosi	1
Teaching Secondary Mathematics	D. Brumbaugh	1

content. Thirty five percent of the syllabi required some form of field experience. The field experiences ranged from observations to teaching several classes for more than one third the semester. Lecture or direct instruction was used in 33% of the syllabi while cooperative learning was used in 37% of the syllabi. Only one syllabus used only lectures

as the instructional approach. The remaining syllabi used a combination of direct instruction, discussion and other approaches.

Approaches that were not widely reported in the syllabi were demonstrations, modeling, discovery or guided discovery and constructivism. Demonstrations by the instructor were on the use of technology or mathematics manipulatives. Fourteen percent of the syllabi explained that they would model teaching strategies in their presentation of course material. Discovery or guided discovery was specifically mentioned in only 9% of the syllabi while a constructivist approach was mentioned in only one syllabus.

The types of projects required in secondary mathematics methods courses could be summarized in five categories: writing assignments, planning, presentations, participation and resource files. The most common projects were writing assignments. The assignments included papers on technology, a position on current issues, textbook analysis, curriculum, current trends and journal article critiques. Two of the course syllabi required write-ups of interviews. One had students interview a teacher on the use of manipulatives and the other interviewed a child about mathematics.

Included in the writing category is journal writing. Journals were defined in four ways. The first was summarizing, highlighting and reacting to readings in and out of class. Second was reflecting on activities, discussions and questions asked by the instructor or class. A third were reflections on personal growth of pedagogical content, changes in philosophy, and/or changes in the approach to teaching mathematics. A final definition was a diary of experiences and growth in the student's school participation experience.

A second major assignment was some form of student presentation or teaching. This was in the form of micro-teaching a mathematics lesson, presenting materials, or presenting on issues in mathematics and mathematics education.

A third category was developing planning. Some course syllabi required lesson plans while others required unit plans, curriculum plans and in one case a yearly plan. Only 14% of the syllabi required students to develop any form of assessment. Included were projects that developed peer evaluations, alternative assessments and written tests.

Twenty-three percent of the syllabi required observations in a secondary classroom and 23% of the syllabi required participation in the classroom. Some courses required both, observations at the beginning of the course with participation after one third of the course was completed.

The final category of projects outlined in the syllabi was some form of a resource file. This included simply surveying the resources of a local school to collecting copies of materials to developing games, bulletin boards or other activities for the classroom. A few course syllabi required the completion of content problem sets and three syllabi required the attendance of a local conference or joining NCTM or the state association.

The final area of analysis was the type of assessment used in these methods courses. We developed four categories. The first category is the use of exams. Seventy-four percent of the syllabi had exams as a part of the assessment process. This included quizzes, take home finals, midterms and finals. Nine of these syllabi combined exams with portfolio assessment, the second category. Portfolios were described as a collection of materials from class that were reflective representations of work done over the semester. Most included material found outside class as well. Few syllabi included in the description self-assessment, analysis and rationale of each artifact included.

The third category of assessment type was a content competency exam. Four syllabi indicated that they required successful achievement on the content competency exam. The final category was other types of assessments. Four syllabi required self evaluation. Two required peer evaluations and one required a final written reflection.

Besides the categories discussed, the syllabi revealed a variety of topics taught in methods courses. These included, for example, diverse needs of students, special education, gender issues, classroom management, mathematics anxiety and questioning strategies. Approximately one-third of the course syllabi address technology. Some syllabi required students to use graphing calculators and the World Wide Web to develop lesson plans or activities. Few syllabi required the review or use of software. Multimedia, spreadsheets, videos and computing language were each required in at least one syllabus.

The final reading determined the extent with which the NCTM *Standards* influenced the syllabi content. Of the syllabi reviewed only six did not mention the curriculum or professional standards. The remaining syllabi either required or recommended the NCTM *Standards* as a text or referred to these standards within the description of the course.

Conclusions:

We had 19% of the universities surveyed return syllabi of secondary mathematics methods courses. This modest return does not allow us to generalize that the results of this

study represent the population of mathematics education methods courses. However, this study does provide a range of potential approaches for preparing preservice teachers. From this sample of syllabi, discussions, lab experiences and student presentations are the most used approaches, with lecture or direct instruction and cooperative learning each used by approximately one-third of the courses for some instruction.

With the increased emphasis by NCTM on writing in the mathematics classroom, nearly three quarters of the syllabi required writing projects. As expected, planning lessons and units is a major project in methods courses as is some form of presentation or peer teaching. Surprisingly less than one-third of the course syllabi required students to develop a resource file and only 14% had students develop any form of assessment.

The most common form of assessing students in methods courses were exams, which were used in nearly three quarters of the courses. Approximately one-quarter of the courses require students to develop a portfolio. Some courses used self evaluations and peer evaluations as part of the final assessment process.

This study was not concerned with finding the "best" ways to teach a methods course, but was concerned with describing ways in which the course can effectively be taught. As expected we have more questions now than at the start of the study. These questions will be used to develop a survey to better answer the question "How are preservice mathematics teachers prepared?"